WHAT IS CLAIMED IS:

1. A pulse detonation system for a gas turbine engine having a longitudinal centerline axis extending therethrough, comprising:

(a) a rotatable cylindrical member having a forward surface, an aft surface, and an outer circumferential surface, said cylindrical member including at least one stage of circumferentially spaced detonation passages disposed therethrough, each said detonation passage further comprising:

(1) a leading portion positioned adjacent said forward surface of said cylindrical member, said leading portion having a centerline therethrough oriented at a designated angle to an axis extending substantially parallel to said longitudinal centerline axis within a specified plane;

(2) a trailing portion positioned adjacent said aft surface of said cylindrical member, said trailing portion having a centerline therethrough oriented at a designated angle to said axis within said specified plane; and,

(3) a middle portion connecting said leading and trailing portions, said middle portion having a centerline therethrough with a substantially constantly changing slope in said specified plane;

(b) a shaft rotatably connected to said cylindrical member; and,

(c) a stator configured in spaced arrangement with said forward surface of said cylindrical member and a portion of said shaft, said stator including at

least one group of ports formed therein alignable with said leading portions of said detonation passages as said cylindrical member rotates;

wherein detonation cycles are performed in said detonation passages so that combustion gases interact therewith to create a torque which causes said cylindrical member to rotate.

2. The pulse detonation system of claim 1, wherein said specified plane is oriented substantially parallel to a tangent of a circumference for said cylindrical member.

3. The pulse detonation system of claim 1, wherein said designated angle of said centerline for said leading portion is in a range of approximately 0° to 75° to said axis.

4. The pulse detonation system of claim 1, wherein said designated angle of said centerline for said trailing portion is in a range of approximately 0° to -75° to said axis.

5. The pulse detonation system of claim 1, wherein said designated angle of said leading portion and said designated angle of said trailing portion have a substantially equal magnitude.

6. The pulse detonation system of claim 1, wherein said designated angle of said leading portion and said designated angle of said trailing portion are oriented on opposite sides of said axis.

7. The pulse detonation system of claim 1, wherein said specified plane is oriented so as to be at a first angle to a first plane extending substantially parallel to a tangent of a circumference for said cylindrical member and at a second angle to a second plane

extending substantially radially through said cylindrical member.

8. The pulse detonation system of claim 7, wherein said first angle is in a range of approximately 0° to 75°.

9. The pulse detonation system of claim 7, wherein said second angle is in a range of approximately 0° to 45°.

10. The pulse detonation system of claim 7, said designated angle of said centerline for said leading portion further comprising a first component in a range of approximately 0° to 75° with respect to said axis and a second component in a range of approximately 0° to 45° with respect to said axis.

11. The pulse detonation system of claim 7, said designated angle of said centerline for said trailing portion further comprising a first component in a range of approximately 0° to –75° with respect to said axis and a second component in a range of approximately 0° to -45° with respect to said axis.

12. The pulse detonation system of claim 1, wherein said port groups of said stator are oriented at a designated angle to said longitudinal centerline axis.

13. The pulse detonation system of claim 12, wherein designated angle of said port groups is greater than said designated angle of said leading portion for said detonation passages.

14. The pulse detonation system of claim 12, wherein said port groups are oriented at an angle to said longitudinal centerline axis in a range of approximately 45° to 85°.

15. The pulse detonation system of claim 12, wherein a difference between said

designated angle of said port groups and said designated angle of said leading portion is within a range of approximately 10° to 65°.

16. The pulse detonation system of claim 1, further comprising at least one disk connecting said shaft and said rotatable cylindrical member.

17. The pulse detonation system of claim 1, wherein said detonation passages of each detonation stage are symmetrically spaced within said cylindrical member.

18. The pulse detonation system of claim 1, wherein said detonation passages are integral with said cylindrical member.

19. The pulse detonation system of claim 1, wherein said detonation passages are formed in replaceable segments connected to said cylindrical member.

20. The pulse detonation system of claim 1, further comprising a plurality of detonation stages in said cylindrical member.

21. The pulse detonation system of claim 20, said detonation passages of each said detonation stage being arranged in a substantially annular configuration through said cylindrical member having a distinct radius.

22. The pulse detonation system of claim 1, each said group of ports in said stator further comprising an air port in flow communication with a source of compressed air.

23. The pulse detonation system of claim 1, each said group of ports in said stator further comprising a fuel port in flow communication with a fuel source.

24. The pulse detonation system of claim 1, each said group of ports in said stator further comprising a port having a device for initiating a detonation wave associated therewith.

25. The pulse detonation system of claim 1, further comprising a plurality of port groups provided in said stator, wherein a plurality of detonation cycles occur in a predetermined timing and sequence in each said detonation passage during a revolution of said cylindrical member.

26. The pulse detonation system of claim 25, said stator including a predetermined amount of circumferential space between each said port group.

27. The pulse detonation system of claim 1, further comprising a seal plate positioned between said stator and said forward surface of said cylindrical member.

28. The pulse detonation system of claim 1, wherein a cross-sectional area through said detonation passages is substantially constant.

29. The pulse detonation system of claim 1, wherein a cross-sectional area through said leading and trailing portions of said detonation passages is not substantially constant.

30. A method of providing power to a drive shaft in a gas turbine engine, comprising the following steps:

(a) providing a rotatable cylindrical member having a plurality of spaced detonation passages disposed therethrough;

(b) forming said detonation passages in said rotatable cylindrical member so

that a middle portion thereof has a centerline therethrough with a constantly changing slope in a specified plane through said cylindrical member;

(c) providing a stator in spaced relation to a forward surface of said cylindrical member, said stator having at least one group of ports formed therein;

(d) connecting said cylindrical member to a drive shaft;

(e) performing a detonation cycle in at least some of said detonation passages; and,

(f) producing a torque on said cylindrical member via the interaction of combustion gases with said detonation passages that causes said cylindrical member and said drive shaft to rotate.

31. The method of claim 30, said detonation cycle further comprising the steps of:

(a) supplying compressed air to said detonation passages;

(b) injecting fuel into said detonation passages;

(c) initiating a detonation wave in said detonation passages; and,

(d) exhausting products of combustion from said detonation passages through an aft surface of said cylindrical member.

32. The method of claim 31, wherein said detonation wave is initiated at a predetermined point in said detonation passage.

33. The method of claim 30, further comprising the step of causing said cylindrical member to rotate at a predetermined speed prior to injecting fuel into said detonation passages.

34. The method of claim 30, further comprising the step of aligning said detonation passages in a predetermined timing and sequence with an air port in said stator, a fuel port in circumferentially spaced relation to said air port, and a port having an initiation device associated therewith in circumferentially spaced relation to said fuel port.

35. A gas turbine engine, comprising:

(a) a fan section at a forward end of said gas turbine engine including at least a first fan blade row connected to a drive shaft;

(b) a booster compressor positioned downstream of said fan section, said booster compressor including a first compressor blade row and a second compressor blade row connected to said drive shaft and interdigitated with said first compressor blade row; and,

(c) a pulse detonation system for powering said drive shaft, said pulse detonation system further comprising:

(1) a rotatable cylindrical member having a forward surface, an aft surface, and an outer circumferential surface, said cylindrical member including at least one detonation stage having a plurality of spaced detonation passages disposed therethrough and being connected to said drive shaft, each said detonation passage further comprising:

(a) a leading portion positioned adjacent said forward surface of said cylindrical member, said leading portion having a centerline therethrough oriented at a designated angle to an axis extending substantially parallel to said longitudinal centerline axis within a specified plane;

(b) a trailing portion positioned adjacent said aft surface of said cylindrical member, said trailing portion having a centerline therethrough oriented at a designated angle to said axis within said specified plane; and,

(c) a middle portion connecting said leading and trailing portions, said middle portion having a centerline therethrough with a substantially constantly changing slope in said specified plane; and,

(2) a stator configured in spaced arrangement with said forward surface of said cylindrical member and a portion of said shaft, said stator including at least one group of ports formed therein alignable with said leading portion of said detonation passages as said cylindrical member rotates;

wherein detonation cycles are performed in said detonation passages so that combustion gases interface therewith to create a torque which causes said cylindrical member to rotate and power said fan section and said booster compressor.

36. A gas turbine engine, comprising:

(a) a bellmouth at a forward end of said gas turbine engine;

(b) a compressor positioned downstream of and in flow communication with said bellmouth, said compressor including a first compressor blade row and a second blade row connected to a drive shaft and interdigitated with said first compressor blade row;

(c) a load connected to said drive shaft; and,

(d) a pulse detonation system for powering said drive shaft, said pulse detonation system further comprising:

(1) a rotatable cylindrical member having a forward surface, an aft surface, and an outer circumferential surface, said cylindrical member including at least one detonation stage having a plurality of detonation passages disposed therein and being connected to said drive shaft, each said detonation passage further comprising:

(a) a leading portion positioned adjacent said forward surface of said cylindrical member, said leading portion having a centerline therethrough oriented at a designated angle to an axis extending substantially parallel to said longitudinal centerline axis within a specified plane;

(b) a trailing portion positioned adjacent said aft surface of said cylindrical member, said trailing portion having a centerline therethrough oriented at a designated angle to said axis within said specified plane; and,

(c) a middle portion connecting said leading and trailing portions, said middle portion having a centerline

therethrough with a substantially constantly changing slope in said specified plane;

(2) a stator configured in spaced arrangement to said forward surface of said cylindrical member and a portion of said shaft, said stator including at least one group of ports formed therein alignable with said leading portion of said detonation passages as said cylindrical member rotates;

wherein detonation cycles are performed in said detonation passages so that combustion gases interface therewith to create a torque which causes said cylindrical member to rotate and power said compressor and said load.